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THE OPERATIONAL LEVEL OF WAR: RADICAL CHANGE NEEDED TO SUPPORT THE AMERICAN RMA

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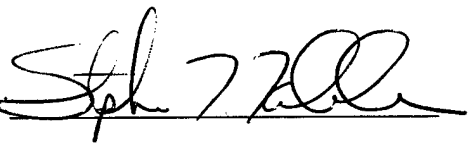
A paper submitted to the Faculty of the Naval War College in partial satisfaction of the requirements for the Department of Joint Military Operations.

The contents of this paper reflect my own personal views and are not necessarily endorsed by the Naval War College of the Department of the Navy

Signature: 

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Information technology continues to grow at an enormous pace all over the world, increasing the speed of information exchange and subsequent availability of knowledge. The industrial age has given way to the information age, and the truth of the adage, "knowledge is power" will yield a vast array of wielders that will require strong leadership to contain. For operational commanders to maintain an advantage over other emerging information savvy opponents, they must fundamentally alter the way operations are conducted and must do so now.

The fundamental factors of time, space and force will still apply in a futuristic world where arguably instantaneous information will allow a completely clear battlefield. Regardless of how it is done the operational commander must still dictate all three. The lessons learned in the past will provide future foes the necessary tools to exploit an American weakness -- the speed of maneuver has not kept pace with the speed of strike, let alone the speed of information. The technology is presently here to alter the way that the United States fights in a CONUS-to-Objective Maneuver that increases the speed of maneuver to one that matches both the speed of strike and the speed of interaction in a globally connected society. The U.S. military must start changing its concepts to drive technology to meet them, thereby dictating a huge space with a mandated smaller force and shorter time. To not adjust now will leave the United States with a weakness that they helped foster.

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ABSTRACT

Information technology continues to grow at an enormous pace all over the world, increasing the speed of information exchange and subsequent availability of knowledge. The industrial age has given way to the information age, and the truth of the adage, "knowledge is power" will yield a vast array of wielders that will require strong leadership to contain. For operational commanders to maintain an advantage over other emerging information savvy opponents, they must fundamentally alter the way operations are conducted and must do so now.

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... there is nothing more difficult to carry out, nor more doubtful of success, nor more dangerous to handle than to initiate a new order of things[1]

-Machiavelli
The Prince

Introduction

Successful militaries reside in an ever-present dilemma when it comes to change in peacetime. In a limited resource environment, how does one change to meet a yet unknown threat and still hold the advantage over the current one? In addition to the problems generated by organizational resistance to change, a radical shift in the way one conducts its operations leaves one vulnerable for a time while new ideas are developed, tested, and fully implemented. The natural reaction to this is to maintain that warfare will not radically change, but merely evolve from what currently exists today, allowing a budget constrained force to still be effective. The holders of that belief are the same ones that Napoleon's *Levee en Masse* rolled over in the seventeenth century or the German's *Blitzkrieg* rolled over in the nineteen forties. The ongoing debate whether Revolution's in Military Affairs (RMA) exist is a semantic one, clearly, whatever it is called, warfare radically changed because of the innovations incorporated in the war machines mentioned above. The question then is not *if*, but *when* will the next radical shift in warfare take place and will the United States military be in the lead or left behind?

Information technology (IT) continues to grow at an enormous pace all over the world, increasing the speed of information exchange and subsequent availability of knowledge. The industrial age has given way to the information age, and the truth of the adage, "knowledge is power" will yield a vast array of wielders that will require strong leadership to contain. In order to maintain its political influence in this high-speed environment, the United

States requires a commensurate military capability as well. The six months of preparation preceding Operation Desert Storm might no longer be available for a conflict in this future globally connected society. For operational commanders to maintain an advantage over other information savvy forces they must fundamentally alter the way operations are conducted, and must do so now.

"Joint Vision 2010 is [the] conceptual template that embraces information superiority and the technological advances that will transform traditional operational warfighting concepts into new concepts via changes in weapons systems, doctrine, culture, and organization."[2] These new operational concepts -- dominant maneuver, precision engagement, full dimensional protection, and focused logistics -- will provide our forces with new framework from which to work.[3] This framework, however, is only the beginning of a whole new American way of war. The "Battlespace Dominance" envisioned by Joint Vision 2010 centers on speed through the availability of information that ultimately may allow commanders to know at once the entire situation with postulated prediction of the enemy's next move. The decisions in warfare will increase the operational tempo to one that is limited by the capacity of human thought, not the events that surround him.

This high-speed, information based competitive space then, requires a different operational force than the traditional large campaign paradigm, to accommodate its different rule set. A Continental United States (CONUS) based maneuver force capable of hypersonic[4] travel employed with decisiveness, depth, and simultaneity will achieve the same objective that the traditional phased campaign force did, but commensurate with the new speed of society. Vice Admiral Cebrowski, author of the Network-Centric Warfare concept, compares different ways to achieve the same result with that of football and soccer. The object in both games is

to score the most points but one team, while effective in its own game, is completely ineffective in the other's rule set or space.[5] As the world changes to a new space, so must the military to be effective. The goal is to develop these concepts and drive the technology to meet them vice the tradition of current technological advances driving the concepts. This paper will combine the basics of maneuver warfare, operational art, and emerging technology to generate a CONUS-to-Objective Maneuver that, if adopted now, will keep the United States on top where it is used to being.

Maneuver Warfare

Much continues to be written on maneuver warfare, its applicability to quick destruction of the enemy, and specifically, on how the United States can benefit from its theory. It is not, however, a new concept. In armies of the past, there was emphasis on maneuvering to someone's flank to attack their weak points, but the traditional view of maneuver warfare truly surfaced in the "Blitzkrieg" attack of France in 1940. It was here that the Prussian successes with railroad and telegraph were refined to include German storm troopers, armor, airplanes, and fires to incapacitate the enemy. The French Army still possessed a large force with the available transportation to move it in a counter offensive, but were unable to do so. Why? "Maneuver refers to an entire style of warfare, one characterized not only by... [movement to positional advantage]... but also – and even more – to moving faster than the enemy, to defeating him through superior tempo."[6]

"Victory [over the French in 1940] was gained through *psychological paralysis* induced by movement, rather than through butchery induced by massive application of firepower."[7] The French Army's paralysis inhibited its ability to make logical decisions. The

army had its "OODA" loop disrupted. William S. Lind, in his article "The Theory and Practice of Maneuver Warfare," gives an enlightening precise definition of "OODA" Loop:

> [C]onflict can best be understood as time-competitive cycles of observing, orienting, deciding and acting [OODA]. Each side begins by observing, through military intelligence, reconnaissance, the commander's own eyes and ears, etc. On the basis of the observation, each orients; that is to say each makes up a mental picture of his situation relative to his opponent. On the basis of the orientation, each makes a decision to do something; then he acts. Assuming the action has changed something each must then observe again, and the cycle begins anew. Whoever can go through this "Boyd Cycle" or "OODA" Loop consistently faster gains a tremendous advantage, primarily because by the time his opponent acts, his own action has already changed the time margin by which the enemy is irrelevant grows.[8]

The German superior tempo invaded the French OODA loop and rendered what decisions they made irrelevant. The tempo psychologically destroyed their *ability to resist* and therefore, their *will*. If a military can defeat an enemy's will, the enemy can no longer see a means to victory, no longer effectively fight, and is defeated. Put another way, Robert McQuie writes: "Where maneuver was the decisive influence, ... recognition of defeat appears to have arisen from a look toward the future and an enemy's potential capabilities rather than toward the past and casualties he has inflicted.[9]

"Maneuver Warfare, which has been defined as a thought process which seeks to pit strength against weakness to break the enemies will, can be contrasted with methodical or attrition warfare, which seeks advantage through cumulative tactical engagements leading to the weakening and ultimate physical collapse of the enemy."[10] Through the concept of maneuver warfare then, large traditional forces to battle enemies are no longer needed. Logically, if a smaller force through maneuver can defeat the enemy, the entire military of the United States can radically change and still maintain its required dominance. The large-scale

force on force battle can be replaced with a smaller more "maneuverable" force that can exploit the adversary's mental calculation of his existing situation.

These basics of maneuver warfare pervade our approaches to warfare today and will continue to do so in the future. The IT technology that Joint Vision 2010 postulates will give real time information to the warfare commander that arguably will decrease the fog of war and make the battlespace completely clear. As mentioned, it is speculated that through the vast information available all facets of the enemy can be instantly known. Perhaps the result of the IT RMA, or system of systems, will be to truly remove the need for physical application of force: knowledge of all of the belligerent's strengths, weaknesses, motives, intentions, and the like will be enough to deter bloody war, declaring the one with the largest *advantage*, as defined by the clear information available to *all players*, the victor. Why go to war if you know you are going to lose at the outset? This possible mature stage of the IT RMA raises an important central question: will we need a force to physically fight a war on the ground? Though victory without fighting, as envisioned by Sun Tzu, may someday occur, it is unlikely. "Information control must always be backed up by the enemy's belief in one's ability and will to apply real force – and significant demonstrations of that capability may always have to be made in combat."[11] Regardless of how far the IT RMA progresses, some belligerent eventually will test the physical resolve of his opponent to determine if the postulated capability is a reality.

CONUS-to-Objective Maneuver

The current trend in the political leadership of the United States is to rely on firepower alone to affect an opponent's will and achieve political objectives. The risk of friendly

casualties is low and firepower is employable nearly on demand, thereby keeping pace with the decisions of state. This traditionally, however, does not effect will. Over reliance on firepower yields a defensive stalemate of attrition that is only overcome when the speed of maneuver matches the firepower.[12] If Robert McQuie, as discussed above, is correct, then maneuver is the only way to affect will. This is certainly evident in the U.S. strategic bombing campaigns of Germany in World War II and Iraq in the Gulf war. Enormous firepower rained down on these states inflicting heavy damage, but defeat of enemy will was not realized until maneuver forces were employed. The U.S. Army's General Reimer argues in his article "Dominant Maneuver and Precision Engagement" that a balance must be struck between the two to provide the operational commander with decisive multidimensional capabilities and choice.[13] U.S. maneuver forces have not kept pace with the speed of strike. Tomahawk cruise missiles and precision strike aircraft are employed nominally at 400 miles per hour, while maneuver forces are employed an order of magnitude slower.[14] The availability of information will speed up policy decisions ensuring the U.S. continued reliance on precision strike, only widening this gap. For a balance, now and in the future, the maneuver force has to function in the same competitive space as the firepower--it must speed up.

An effective ground force currently relies on ports and airfields to allow for build-up and force sustainment. As mentioned above, the amassing of forces in the Persian Gulf allowed for unparalleled success against Iraq. Any student of current warfare undoubtedly will not make the same mistake Saddam Hussein did, by allowing a huge force to amass. Area denial has become an effective asymmetric strategy to defeat phased campaign style warfare like the U.S. employs. As the U.S. continues to relinquish its overseas bases, the Army and Air Force will have to rely on political savvy beyond their control to secure basing to allow for

their power projection. Similarly, the Navy and Marine Battle Groups and Amphibious Ready Groups may be held out of effective tactical range with improved enemy weapon systems in the littoral area. The Chief of Naval Operations, Admiral Jay Johnson, has argued that "countering a potential adversary's area denial efforts will become the single most crucial element in projecting and sustaining U. S. military power where it is needed."[15] The United States needs other ways to get its troops to the fight.

The Army After Next (AAN) project is the U.S. Army's program that looks at futuristic warfighting, currently out to the year 2025. In its fiscal year 1997 wargame series: "strategic speed—the very rapid deployment [of forces] directly into a theater of operations-- ... allowed political leaders and military commanders to accelerate movement to a theater of war before the enemy can set or make a preemptive move."[16] Through this strategic lift, the enemy OODA loop was thoroughly disrupted but in this context it was done with *movement* not *maneuver*. The forces in the Winter Wargame of the 1997 series still relied on a forward debarkation/logistics base of operations to assemble prior to maneuvering. The area denial capability mentioned above places the whole operational success on having that logistics base. Similarly, the transition time from deployment to maneuver will prove ineffective as the speed of battle continues to increase. What is needed is movement of forces from a CONUS base of operations directly into battle and back with the capability of achieving operational and strategic results through global maneuver.

In the current U.S. Marine Corps concept, "Operational Maneuver from the Sea," strategic or operational objectives are accomplished amphibiously, vice merely securing a beachhead for follow-on operations.[17] The Marines are currently developing a further concept for direct confrontation with the enemy, Ship-to-Objective Maneuver. "Ship-to-Objective

Maneuver takes advantage of emerging mobility and command and control systems to maneuver landing forces in their tactical array from the moment they depart the ships, replacing the ponderous ship-to-shore *movement* of current amphibious warfare with true amphibious *maneuver*."[18] The Marines envision a force that attacks with such speed and depth that the enemy will be overcome by superior tempo, denying them a coherent "OODA" cycle. Additionally, "by requiring the enemy to defend a vast area against our seaborne mobility and deep power projection, naval forces will render most of his force irrelevant".[19] A CONUS-to-Objective maneuver can mirror this concept very well. The Marine Corps is relying on the V-22 Osprey to allow for this deep maneuver. The Army needs a vehicle that would allow CONUS-to-Objective Maneuver to collapse the physical distance of earth to a tactical sized battlespace. Transportation of this nature is not as far fetched, as it seems.

Hypersonic Travel

The technology for commonplace orbital travel is here. Civilian research continues daily to harness the Reusable Launch Vehicle (RLV) for commercial gain. On April 12, 1981, the Space Shuttle Columbia lifted off and the world entered a whole new arena in space travel. RLV's were now capable of launching to space, performing a mission and returning to earth to be used again. The cost however, was, and remains, enormous. Every time the space shuttle lifts off it costs 500 million dollars,[20] requires a huge manpower infrastructure, and allows 240 tons of used rocket assemblies to fall uselessly into the ocean.[21] As a result of this cost, concurrent traditional rocket technology is still being used to put commercial and military satellites into orbit, but this method is only slightly cheaper and provides no way of repair or retrieval. It is estimated that by 2010, there will be a tenfold increase in satellites in

orbit requiring placement and service.[22] NASA also continues to work on its space station and will undoubtedly need a replacement for the costly and cumbersome space shuttle to service it.

The basic law of supply and demand then, has spawned enormous research and produced the spaceplane concept, which allows a hybrid vehicle to operate in both space and the atmosphere. These vehicles employ a single-stage-to-orbit engine thus removing the need for disposable rocket boosters, and advanced thermal shielding for re-entry, to decrease the turnaround time on the ground and increase airframe longevity. Both are current limitations of the space shuttle. The ongoing joint X-33 research and development project with NASA and Lockheed Martin is scheduled to launch in July 1999, with these improvements. This sub-orbital vehicle will use a scramjet engine (a new innovation capable of supersonic combustion) to achieve a maximum altitude of 200,000 feet and a speed of Mach 13.[23] Following successful tests of the X-33, Lockheed Martin will build a full-scale version, the Venture Star. It will employ a thermal shield able to withstand 100 re-entries, scramjet aerospace engines enabling it to reach Mach 13 and a forty thousand pound payload capacity, all decreasing the launch cost per pound *ten fold* from the current level.[24] Though designed for space, the speed of this hypersonic travel has enormous global uses as well. The speed of transportation, both civilian and military, increases more than an order of magnitude with a Mach 13 vehicle, and does so at a more reasonable cost. Demand will continue to produce industry to supply this capability both to the U.S. and threat nations.

The Future Operation

The worldwide information dominance does not eliminate the fundamental factors of operational art; time, force, and space. Operational art links the tactical employment of forces to strategic objectives.[25] When the bluff is called, the operational commander still must dictate a space with a force over some time. On demand firepower is an insufficient force alone, area denial efforts mandate a huge global space, and speed of information yields limited time. Through the coordination of the operational factors of space, time, and force and the principles and facets of operational art, a highly capable, well trained and skillfully led force guided by sound strategy can defeat an even much stronger opponent.[26] Operational commanders must take advantage of time and harness speed for maneuver, to balance the overwhelming firepower and take advantage of the space that enemy area denial has given them. This is accomplished through CONUS based maneuver warfare where multiple units are deployed directly to and from the conflict in rapid simultaneous and synchronized attacks in depth. This creates a tempo for the enemy that he can not adjust to, and yields a force advantage through the manipulation of space and time.

Consider the following: U.S. foreign policy requires decisive action to be taken on the other side of the world. Instead of the "rapid" movement of our traditional home based force and its logistical tail by ship, or a C-17 standing by to move an AAN force to a required base twenty-two hours away with follow on maneuver from there, imagine a scenario in which spaceplanes are able to surgically place units at the most decisive points in the area of responsibility in ninety minutes and extract it in the same amount of time.[27] Operational commanders could meet their theater objectives in an afternoon, and have everyone home for

dinner in the evening. This picture is riddled with arguments, but only when likened to warfare of the present.

First, where is the infrastructure to support this spaceplane? If there were a conventional runway as is needed for the C-17, spaceplanes would merely perform as traditional airplanes do. However, in a situation with no available runway, or even in spite of an existing one, a different type of RLV is available. "McDonnell Douglas has proposed a vertical takeoff and landing unwinged [RLV] that draws heavily on its earlier successful DC-X Clipper Graham experimental [RLV]."[28] The spaceplane of this nature would function like current AV-8 Harrier or V-22 Osprey aircraft and require no support when at its objective.

Second, what would a small force be able to do operationally in any sort of conflict? Through CONUS-to-Objective Maneuver and traditional operational art, it would be very effective. Utilizing superior knowledge derived from information superiority, multiple force packages could be simultaneously maneuvered to numerous precise locations in depth. Simultaneity and depth allow increased operational tempo that give the greatest advantage by "bring[ing] force to bear on the opponents entire structure in a near simultaneous manner that is within the decision making cycle of the opponent ... overwhelm[ing] and crippl[ing] enemy capabilities and will to resist.[29] Similarly, all of the operational principles of war are directly supported by this maneuver.[30] Most notably, it is extremely offensive, relies on and achieves surprise, and directly concentrates its effects at a chosen place and time for decisive results (mass). The principle of simplicity is perhaps arguable, but the IT RMA gives the commander a level of situational awareness so much greater than today, that this deep operation will be no more complicated than any other one. The force no longer has to be like the traditional large one to achieve operational objectives.

Third, who or what will provide fires for this new force? Fires would be supported from either a space precision weapon or possibly even earth bound rail guns in addition to traditional airborne assets. "A notional rail gun could deliver 150 pound GPS/INS guided projectiles with an impact velocity of Mach 6 to targets at ranges up to 400 miles at a rate greater than six rounds per minute. Mature rail gun technology is predicted to produce even greater capability."[31] Furthermore, the Army is developing the Crusader, employing composite armor, state-of-the-art mobility subsystems, advanced robotics, and laser ignition that will speed the delivery of highly responsive long range effects...increasing total force effectiveness by 52 percent from the current levels.[32] The reliance by the military on precision weapons will undoubtedly drive continued research and effectiveness, allowing this global maneuver to work through immediate interoperability with the maneuver force. "[Perhaps] by 2025, a soldier on foot or at the console in a command center, might acquire a target and just pull a trigger or push a button to deliver the effects desired by the commander."[33]

Fourth, how will these combat forces be sustained logistically when the situation deteriorates, preventing timely extraction, or requires a longer time on the ground to mass effects and affect enemy will? For the global maneuver force to be economical, feasible, and effective, only the warfighters must be deployed. The entire logistical support paradigm must be altered and its tail shrunk to almost nothing.

All support infrastructure will remain in CONUS with the warfighters having everything they need with them. Emergency resupply could be conducted remotely by precisely delivering appropriate supply pods to the maneuver force from Unmanned Aerial Vehicles (UAV) overhead. Advances in materials, biotechnology, and weaponry must continue to improve to accomplish this. The AAN project has deduced from its wargames

that lighter, more effective materials must continue to be developed to enable the biggest advantage for the ground fight. Similarly, advances in fuels, propulsion sources, and power sources are required.[34] Weapons must continue to advance beyond the current directed energy weapons, laser weapons, microwave sound weapons, and advanced traditional weapons like the M16A2.[35] Finally, the huge advances in biotechnology of late must continue; to eradicate the logistical tail. Biotechnology is the manipulation of living systems or parts of them to produce or modify existing things and it raises a vast amount of possibilities.[36] It may someday be possible to immunize against nuclear, biological and chemical warfare, or generate rapid wound healing through cell manipulation. Similarly, food could be manufactured, fuel generated, or explosives made all from common materials in the natural local surroundings. Easiest to comprehend is the ability to enhance human performance. A family of drugs called Synaptic Plasticity and Memory Formation Drugs are being developed to combat Alzheimer's disease. The U.S. Air Force Office of Scientific Research is considering these experimental drugs to "increase [soldiers] memory and learning capabilities, enabling them to better operate in an increasing sophisticated battlefield.[37] In their article "Fooling Mother Nature" for the Airpower Journal, Evan De Renzo and Richard Szafranski comment that caffeine and pacemakers are certainly accepted performance enhancers, but will soldiers be accepted if they are chemically enhanced to keep them alert or allow them to think faster, or rid them of fear?[38] The environment envisioned in CONUS-to-Objective Maneuver is extremely intense. Add to that a soldier able to operate at peak performance physically and intellectually for a period of days without any effects, and the enemy's OODA loop would undoubtedly be influenced.

Science fiction? No. The feasibility of a vertically launched space vehicle to deploy and extract military forces in a conflict that may last only a matter of hours seems far-fetched because problems with spaceplane technology are easily deduced in light of our current *understanding* of transportation. Yet, less than a century ago, when the Wright brothers postulated powered flight with an airplane at Kitty Hawk, this mode of transportation was erroneously considered a science fiction concept. People *understood* "transportation" then too -- flying was for the birds. Even when the Wright brother's airplane finally did fly, a mention that airplanes would someday have the capability to deploy a large number of people to all parts of the world in a matter of hours, was looked on with lunacy. Similarly, the postulation of precision guided weapons, personal computers, or even cloning undoubtedly garnered a quizzical look just thirty years ago. In 1965 Gordon Moore projected that the number of transistors capable of being placed on a microchip would double every twelve to twenty-four months. Moore's correct prediction has now pervaded the biotechnology field with genetic information and libraries expanding at the same rate.[39] The exponential rate of technological change in the world has eroded people's capability to ascertain the feasible – they have yet to realize the possible is limited now only by imagination. Finally, the thought that small forces can achieve, in the future, what is accomplished by huge forces today, may have skeptics, but again the experience of Americans is implanted in their traditional view of warfare. Operational commanders will be able to fulfill their mission with an entirely different "light" force. Their traditional competitive space is changing and with technology as an enabler, the possible is almost incomprehensible.

The Time to Innovate is Now

The theory, technology, and future operation give reasons for the implementation of radical change in the way we fight wars, but reasons to innovate go much farther. Organizational change in a bureaucracy traditionally takes an extremely long time to accomplish and the U.S. military is undoubtedly the epitome of a bureaucratic organization. The worry that the relative peace the United States currently enjoys is stifling innovation like it did in the inter-war years of World Wars I and II has provided a large impetus to determine in what direction warfare is heading. The Department of Defense has directed that American warfare go along the information path and, through Joint Vision 2010 has empowered the services to adopt new doctrine. The Navy, Marine Corps, Air Force, and Army are moving toward the full "system of systems" type of warfare discussed, requiring an increase in operational tempo to be effective. Even if the military situational awareness is so good that it can radically influence the enemy's OODA cycle, it still must have the balanced physical means to take advantage of that influence or it gains nothing. Along with its high-speed firepower, U.S. ground forces must also be able to operate at the speed of the IT RMA or be ineffective.

Moreover, for the IT RMA to continue to *develop*, so must physical implements to employ forces in it. If the information advantage is merely postulated and never militarily utilized, the revolution will die for lack of perceived need and the superiority of the United States' power base will be weakened. Initially, utilization will be accomplished through the Marines' "Operational Maneuver From The Sea"

utilizing V-22 for deployment of forces directly to the objective followed by logistical trails to support it.[40] The IT RMA, if allowed to run its course, will ultimately leave this capability for being too slow. Something must reflect the future speed of warfare.

In another light, the commercial possibilities of an RLV are staggering. The military is not the only institution that is speeding up - the entire world is. Worldwide industry wants inexpensive routine space access. The New York Times reported in December 1998 that the American company Hughes Space and Communications in an effort to take advantage of cheaper space travel provided advanced rocket technology to China.[41] Just the increase in satellite launch, repair, and retrieval requirements postulated in the early twenty-first century guarantees a market for the RLV and they will continue to evolve. In 1993, the Interavia periodical published a report stating: "The Tupolev Design bureau says that it has begun bench testing several structural elements for a new single stage to orbit hypersonic aircraft capable of speeds up to Mach 20-25, the Tu-2000."[42] For the U.S. military to avoid these facts and not innovate would render the information technology, that it has spawned, an advantage for someone else to benefit from. With respect to the IT RMA, and arguably spaceplanes and the postulated CONUS-to-Objective Maneuver, Eliot Cohen provides this sobering quote: "To the extent that the revolution proceeds from forces in the civilian world, the potential will exist for new military powers to emerge rapidly. A country like Japan or, in a few years, China, will quickly translate civilian technological power into its military equivalent."[43]

Conclusion

"When revolutionary changes occur in warfare, most of the time it is because there has been a change in frequency at some level -- a change in how fast some things happen."[44] The world is speeding up and the access to information has allowed an entirely different threat than the traditional Soviet attrition-based threat of the late 20th century, to emerge. Technology is advancing to support the hypotheses in this paper and, arguably, the organizational change to embrace the American RMA has slowly begun. Financially, space will become affordable as the market demands it to, allowing any threat to take advantage of that speed medium. The reliance of firepower alone does not allow American will to be imposed on others as required by political considerations; there has to be a commensurate maneuver force that can react at the speed of the global environment. Additionally, the United States will continue to develop its society to meet the ever-changing speed of the world, and so will its military. By taking the lead in this IT RMA, others will ride on American coattails and eventually possess some, if not all, of the same capabilities. If the operational commanders are not ready to fundamentally change their way of war, the United States will be unable to effectively implement its policy and will be left with a weakness that it helped to foster.

NOTES

[1] Niccolo Machiavelli quoted in Stephen Peter Rosen, Winning the Next War: Innovation and the Modern Military (Ithaca: Cornell Press, 1991) 1.

[2] William S. Cohen, "The Revolution in Military Affairs," Annual Report to the President and the Congress, 1998, 118.

[3] Joint Chiefs of Staff, Joint Vision 2010, (Pentagon, Washington D.C.:1995), 19.

[4] Hypersonic refers to speeds greater than five times the speed of sound, Mach 5.

[5] Arthur K. Cebrowski, "Network-Centric Warfare," Lecture, U.S. Naval War College, Newport, RI: 17 December 1998.

[6] William S,. Lind, "The Theory and Practice of Maneuver Warfare," in Maneuver Warfare: An Anthology, ed. Richard D, Hooker Jr., (Novato, CA: Presidio, 1993), 4.

[7] Robert H. Scales, "The Cycles of War: Speed of Maneuver Will be the Essential Ingredient of an Information-Age Army," Armed Forces Journal International, July 1997, 39. (Emphasis Added)

[8] William S,. Lind, "The Theory and Practice of Maneuver Warfare," in Maneuver Warfare: An Anthology, ed. Richard D, Hooker Jr., (Novato, CA: Presidio, 1993), 9. (Emphasis Added)

[9] Robert McQuie, "Battle Outcomes: Casualty Rates as a Measure of Defeat," Army, 1987, 33.

[10] Richard D. Hooker, Maneuver Warfare: An Anthology, (Novato, CA: Presidio, 1993), 271.

[11] James R. FitzSimonds, "Intelligence and the Revolution," in U.S. Intelligence at the Crossroads, ed. Roy Godson, Ernest May, and Gary Schmitt(Washington D.C.: Brassey's, 1995), 273.

[12] Robert H. Scales, "The Cycles of War: Speed of Maneuver Will be the Essential Ingredient of an Information-Age Army," Armed Forces Journal International, July 1997, 38.

[13] Dennis J. Reimer, "Dominant Maneuver and Precision Engagement," Joint Forces Quarterly, Winter 1996-97, 14.

[14] 400 miles per hour was figured on a nominal speed of .8 Mach while an order of magnitude slower or 40 miles per hour was derived from General Scales article "Cycles of War" where he postulates a maneuver speed currently at 40 kilometers per hour.

[15] Jay Johnson, quoted in Thomas G. Mahnken, "Confronting the Area-Denial Threat," Proceedings, September 1998, 36.

[16] U.S. Army Training and Doctrine Command, Knowledge and Speed: The Annual Report on The Army After Next Project to the Chief of Staff of the Army, (Washington: 1997), 15.

[17] Paul K. Van Riper, Ship to Objective Maneuver, (Quantico, Va: July 25, 1997), 12.

[18]Ibid, 4. (Emphasis Added)

[19] Ibid, 6.

[20] Bill Sweetman, "Spaceplanes: Who Can Afford Them?" Interavia/Aerospace World, March 1993, 26.

[21] "Future Wings: Spaceplanes," produced for the Discovery Channel by Llanishen Films LLC, 1998.

[22] Ibid.

[23] Chris Bulloch, "The Reusable Launcher Quest: Golden Fleece or Fools Gold," Interavia, January 1998, 46.

[24] "Future Wings: Spaceplanes," produced for the Discovery Channel by Llanishen Films LLC, 1998.

[25] Joint Chiefs of Staff. Doctrine for Joint Operations (Joint Pub 3-0) (Washington D.C.:February 1, 1995), II-2.

[26] Milan Vego, "On Operational Art," (Unpublished Book, Third Draft, U. S. Naval War College, Newport, RI: 1998), 1.

[27] Times were figured on a nominal distance of twelve thousand miles(half way around the globe) with a nominal C-17 speed of .9 Mach and a nominal spaceplane speed of Mach 13 with no wind.

[28] Chris Bulloch, "The Reusable Launcher Quest: "Golden Fleece or Fools Gold?," Interavia, January, 1998, 46.

[29] Joint Chiefs of Staff, Doctrine for Joint Operations (Joint Pub 3-0) (Washington D.C.:February 1, 1995), III-11.

[30] The principles of war are Mass, Objective, Offensive, Surprise, Economy of Force, Maneuver, Unity of Command, Security, and Simplicity. See Joint Chiefs of Staff. Doctrine for Joint Operations (Joint Pub 3-0) (Washington D.C.:February 1, 1995), II-1.

[31] James Carman, Mitchell Triplett, James Nault, Russell Bartlett and David Adams, "Innovation for the Interwar Years," Proceedings, February 1998, 27.

[32] Toney Stricklin, "Fire: The Cutting Edge for the 21st Century," Field Artillery, May-June 1998, 24-25.

[33] Ibid, 22.

[34] For a list of the AAN technology short list see Knowledge and Speed: The Annual Report on The Army After Next Project to the Chief of Staff of the Army, page 25. For a comprehensive list of possible future technologies see Star 21: Strategic Technologies for the Army of the Twenty-First Century; Technology Forecast Assessments.

[35] For a discussion of new weapons becoming available to the infantryman, see LCOL Billey E. Wells, USA paper "The Future of Infantry: Maneuver in the Twenty-First Century," 1997, 15-26.

[36] National Research Council, Star 21: Strategic Technologies for the Army of the Twenty-First Century; Technology Forecast Assessments, (Washington, D.C.: 1993), 369.

[37] Pat Cooper, "Memory Drug May Enhance Airmen Abilities," Defense News, April 24, 1995, 4.

[38] DeRenzo, Evan G. and Richard Szafranski, "Fooling Mother Nature." Airpower Journal, Summer 1997, 25-36.

[39] Barnaby J. Feder, "Getting Biotechnology Set to Hatch," The New York Times, 2 May 1998, D:1.

[40] Jay Johnson, "Anytime, Anywhere: A Navy for the 21st Century," Proceedings, November 1997.

[41] Jeff Gerth, "Pentagon Inquiry Faults Missile Maker's China Aid," The New York Times, December 9, 1998, A:1.

[42] Jean Pierre Casamayou and Mike Taverna, "Tupelev's Hypersonic Project," Interavia, March 1993, 29.

[43] Eliot A. Cohen, "A Revolution in Warfare," Foreign Affairs, March/April 1996, 51.

[44] Robert R. Leonard, Fighting by Minutes, Time and the Art of War, (London: Praeger 1994), 69.

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